

# High Risk Profile of Pregnancy in Iodine Deficiency Areas

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**Abstract** - High-risk pregnancy, such as abortion, low birth weight, mortality, congenital defects of fetus, disorders of growth and hypothyroidism, might lead to many serious health problems, especially in iodine deficiency disorders (IDD) endemic areas. The aim of this research is to discover high-risk pregnancy profile in iodine deficiency areas. This research used cross-sectional research design. The population and samples were all pregnant mothers settled in research location which was purposively selected based on high IDD-alleged cases prevalence. The data were collected through observation, structured questionnaire, sampling of blood and urine, followed by laboratory analyses. Iodine deficiency was measured using urinary iodine excretion (UIE), thyroid stimulating hormone (TSH) and free thyroxin (fT4) analyses. The results of the study reveal that they are 27% pregnant mothers with hypothyroidism in IDD endemic areas with more than half (59.5%) have iodine deficiency. Palpation measurement of thyroid gland shows that one third of the respondents (35.1%) have grade I and II gland enlargement. There are 16.2% pregnant mothers at high-risk age and 8.1% with high-risk of gravidarum (G), partus (P), and abortion (A). Most of them (64.9%) have high-risk birth distance. The chi-square test shows no correlation between high-risk factors of pregnancy and GPA. The conclusion of the research is that hypothyroidism is the most prevalent in high risk profile in pregnant women living in iodine deficiencies areas. Other factors are height of pregnant women, period of stay, birth distance and age, respectively. However, statistically they are not significant. Therefore, it is recommended to establish policy on continuous and sustainable program in coordination with related stakeholders and organizations in district level supported nationally by the government.

**Keywords:** *high-risk pregnancy, hypothyroidism, iodine deficiency, pregnant mothers*

## I. INTRODUCTION

Pregnant women are always at risk of health problems or maternal mortal vulnerability. Problems during pregnancy should be seriously taken care of not only by the women, but also by the family and society, particularly on high-risk cases as early as possible. To date, there is no consensus definition for high-risk pregnancy yet this condition is normally defined as when the woman or fetus experiences problem which requires medical treatment or medication[1][2]. Serious problems might occur especially in Iodine Deficiency Disorders (IDD) endemic area in which pregnant women have higher iodine deficiency risk which triggers thyroid dysfunction with bad impact on fetus, such

as abortus, low birth weight, stillbirth, congenital defect, and endemic cretinism [3].

During gestation period, thyroid function increases to suffice both mother and fetus [4][5]. The gland dysfunction, in form of hypothyroidism and hyperthyroidism, is detrimental on both mother and fetus [6]. To prevent increasing risk, complex interaction of various factors during pregnancy should be measured [7] through various steps, such as monitoring goiter incidence and providing sufficient iodine for pregnant women as part of vulnerable groups [8].

Other than those aspects, maternal age is also one of the key factors to determine high-risk pregnancy due to its direct correlation to fetus premature death risk [9]. Young maternal ages are between 15-19 years old [7], or younger than 19 years old [10], and older at  $\geq 35$  years old [11]. Health policy on maternal age is needed as long-term improvement strategy to reduce risk factor gap [12].

It is an urgent need for a change to put pregnancy care promotion and support as priority into policy, health research, and health personnel planning [13], as well as ways to intensify reduce mortality through implementation of preventive and curative intervention related to childbirth and early days of life in the society [14]. Skilled and trained labor personnel's have proven to be able to reduce maternal mortality [15].

Regionally coordinated iodine deficiency prevention programs should be carried out by all stakeholders, such as policy maker and related organizations, to protect future generation through careful assessment on iodine status, legislative commitment on policy and efforts to increase collective awareness, effective monitoring on salt iodization, fortification strategy, and regional and local campaign.[16]. Moreover, knowledge on specific risk factors may help create such screening tool targeting women at higher risk to promote long-term wellbeing of mothers and babies [17].

This research finds high-risk factors of pregnant women living in iodine deficiency prevalent area. Various high-risk factors of pregnant women have already been reported in previous research. However, there is still limited study on those factors in iodine deficiency area, particularly among pregnant women with hypothyroidism.

This research is conducted in the hills and mountain slopes of Ponorogo, a district in Jawa Timur province with ongoing

problem of IDD. The objectives are to study high-risk pregnancy profile in iodine deficiency area and to measure the correlation between high-risk pregnancy to gravida, partus, or abortus (GPA). The information obtained is expected to serve as suggestion for early treatment policy to prevent high-risk pregnancy in iodine deficiency area, for the sake of mothers and their babies.

## II. METHOD

This research was conducted in Dayakan and Watu Bonang villages, two of IDD-endemic area in Badegan sub-district, Ponorogo District, Jawa Timur, in a cross-sectional research. The location was purposively selected based on high level of IDD-alleged cases prevalence. Population and samples were all pregnant women living in research location, four and three hamlets of Dayakan and Watu Bonang, respectively. There were 37 pregnant women as total sample participating in this survey. Inclusion criteria were pregnant women aged between 18-45 years old, at second trimester, whereas those with chronic disease and/or refused to be research subject were excluded.

The data were collected through observation, anthropometry measurement, interview using structured questionnaire, and blood – urine sampling, followed by laboratory analysis. The researchers measured the weight and height of pregnant women using AND and height measurement that had been calibrated previously. The height data was measured using a microtoise tools that had been previously calibrated. Meanwhile, the weight was measured using a digital weight scale which was calibrated every day. All anthropometric measurements were carried out using measurement guidelines.

The research variables were GPA incidence, height, birth distance, pregnant women age, palpation of the goiter, period of stay, urinary iodine excretion (UIE), thyroid stimulating hormone (TSH), and free thyroxin (fT4). The height were classified as high-risk (<145 cm) and normal  $\geq 145$  cm [18]. The short birth distance at <24 months was classified as high-risk [19]. The ages were classified young at <20 years old [10], and too old at  $\geq 35$  years old [11]. The palpation of the goiter was examined in frontal part of neck based on World Health Organization (WHO) 2007 classification of grade 0, I and II. In grade 0, no goiter was palpable or seen. In grade I, goiter was palpable but not seen, in normal thyroid position and size was without enlargement. In grade II, goiter was very visible when swallowing in normal position neck. Total Goiter Rate (TGR) is the sum of Grade I and Grade II, divided by all palpated pregnant women [20]. The UIE levels were categorized as iodine deficient at <150  $\mu\text{g/L}$ , normal at 150-249  $\mu\text{g/L}$ , and excessive >250  $\mu\text{g/L}$  [21]. Hypothyroidism category for TSH based on Human Kit was measured at >7  $\mu\text{IU/ml}$  [22] and fT4 at < 0.76  $\mu\text{IU/ml}$  [23]. GPA was categorized as high-risk from minimum 1 stillbirth incidence or abortus. UIE analysis was performed by 24-hours urine collection. Enzyme-linked immunosorbent assay (Elisa) was used for TSH and fT4 analysis. All laboratory analysis was conducted in Biochemistry Lab of Health Research and Development Centre in Magelang. The data were all

statistically analyzed using descriptive and chi-square analysis to measure correlations among high-risk pregnancy factors through software statistical package for the social science (SPSS).

## III. RESULTS

### A. High-Risk Pregnant Women

In most developing countries with low or moderate GDP, there are many researches on various factors related to young pregnancy. Comprehensive understanding on pregnancy risk factors and protection need to be studied to determine complex interaction of young pregnancy influencing factors [7]. Various researches are conducted related to pregnancy risk factor on birth during antenatal [17] and other research reports birth decrease in young pregnancy [24]. Crafton reports that unplanned pregnancy is part of potential risk [25].

The results in this research show that most of the pregnant women (91.9%) have normal height (Table 1). High hypothyroidism incidence is found to be high (27%) based on TSH and fT4 analysis, higher than that found by Feldthusen on subclinic hypothyroidism prevalence of 17% [6]. More than half of the subjects (59.5%) are iodine deficient based on UIE analysis. There are pregnant women with high-risk partus and abortus at 8.1%. Though low, the number can be a threat as it should not be present in normal condition. There is also 16.2% of pregnant women in high-risk age, indicating young age of the mothers in research location, which brings negative impact since pregnancy in too old or too young age is closely related to detrimental health effect to mothers and babies [10]. Old mother age has higher risk of premature and stillbirth [11].

TABLE I. HIGH-RISK PREGNANT WOMEN

Profile	n	(%)
<b>Height (cm)</b>		
- High-risk	3	8.1
- No high-risk	34	91.9
<b>TSH and fT4 level (<math>\mu\text{IU/ml}</math>)</b>		
- Hypothyroidism	10	27
- No hypothyroidism	27	73
<b>UIE level (<math>\mu\text{g/L}</math>)</b>		
- Iodine deficiency	22	59.5
- Normal	13	35.1
- Excessive	2	5.4
<b>GPA</b>		
- High-risk	3	8.1
- No high-risk	34	91.9
<b>Birth distance (year)</b>		
- High-risk	24	64.9
- No high-risk	13	35.1
<b>Age of pregnant women (years-old)</b>		
- High-risk	6	16.2
- No high-risk	31	83.8
<b>Period of stay (years)</b>		
- >5	30	81.1
- <5	7	18.9
<b>Palpation of thyroid gland enlargement</b>		
- Goiter	13	35.1
- No goiter	24	64.9

Most of the respondents (81.1%) have lived longer than 5 years in iodine deficiency area which might affect mother thyroid function. Besides UIE, TSH, and fT4 level, thyroid function can also be measured through palpation of thyroid gland. One third of the respondents (35.1%) have thyroid enlargement at grade I and II. It is also found that most of pregnant women have high risk birth distance (64.9%). Based on research results, immediate handling on high-risk pregnancy factors in the iodine deficiency area was critically needed.

Policy and program makers should design prevention program pregnancy with consideration on specific high-risk pregnancy factor from individual level to society and district[7], as well as more focused counseling program on fertility and appropriate contraception method to prevent high-risk pregnancy [25]. Besides, diet supplementation can be used as maternal and infant health improvement program[26], such as iodization or food fortification.

*B. Correlation Between High-Risk Pregnancy Profile to Gravida-Partus-Abortus (GPA)*

High-risk factors are generally correlated to pregnancy and birth condition. Pre-pregnancy mother's height evaluation is needed [27] due to safety risk during childbirth. High-risk pregnancy factors found in this research should be immediately handled to prevent more serious health problems, despite no significant overall correlation ( $p \geq 0.05$ ) between risk factor to GPA in pregnant women in the iodine deficiency areas (Table 2).

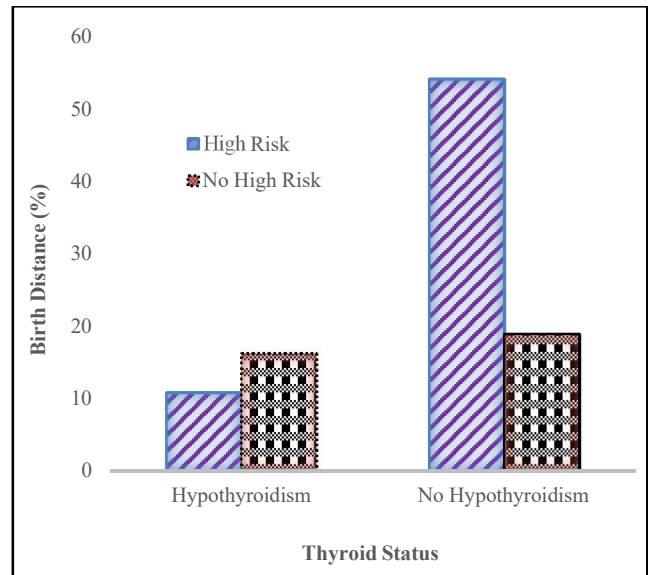
TABLE II. CORRELATION BETWEEN HIGH-RISK PROFILE TO GRAVIDA PARTUS ABORTUS (GPA)

Variable		GPA			
		High-risk		No high-risk	
		n	%	n	%
Height	High-risk	0	0	3	8.1
	No high-risk	3	8.1	31	83.78
Birth distance	High-risk	1	2.7	23	62.16
	No high-risk	2	5.41	11	29.73
Age	High-risk	1	2.70	12	13.51
	No high-risk	2	5.41	22	78.38
Period of stay	$\geq 5$ years	3	8.1	27	72.97
	$< 5$ years	0	0	7	18.92
Palpation	Goiter	1	2.70	12	13.51
	No goiter	2	5.41	22	78.39
Thyroid	Hypothyroidism	2	5.40	8	21.62
	No hypothyroidism	1	2.70	26	70.27
UIE	Iodine deficiency	2	5.41	20	54.05
	No iodine deficiency	1	2.70	14	37.84

$p \geq 0.05$

In this research, there are high-risk factors with correlation to GPA in pregnant women living in the iodine deficiency area, in form of height at  $< 140$  cm (8.1%), less than 2 years birth distance (2.7%), too young or too old age (2.7%), over 5 years period of stay (8.1%), grade 1 and 2 goiter (2.7%), hypothyroidism incidence (5.4%), and iodine deficiency pregnant women (5.41%). There are other researches conducted in iodine deficiency area which report that 54.3% iodine deficiency pregnant women with  $< 150$   $\mu\text{g/L}$  UIE

level [28] and iodine deficiency due to insufficient iodine consumption are found in 80% pregnant women with median UIE level of  $88.6$   $\mu\text{g/l}$  [29]. Correlation between birth distances to thyroid status is shown in Fig. 1. Correlation between ages of pregnant women to thyroid status is displayed in Fig. 2. Correlation between Period Stay to thyroid status is pictured in Fig. 3.

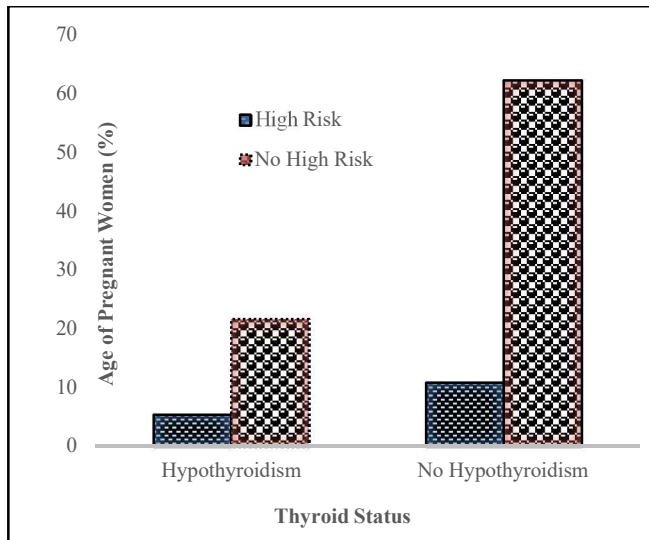


$p \geq 0.05$

Fig 1. Correlation between birth distances to thyroid status

Detrimental effects on pregnancy tend to increase in pregnant women with hypothyroidism compared to those with euthyroid ( $p < 0.05$ ). It is reported that pregnant women with sub-clinic hypothyroidism have high prevalence of maternal health problems than the euthyroid [6]. Another research also finds thyroiditis postpartum prevalence  $> 10\%$  and postpartum thyroiditis 54% prevalence of those with permanent hypothyroidism [30].

Age is another important high-risk pregnancy factor. A research report that pregnant women mostly (53.3%) have age range between 26-35 years [31]. Another research report the correlation between pregnant women in very young age to low birth weight with increased high-risk by 20-30%, and also correlation between very old age to birth risk[10]. However, there is also a report that shows no pregnancy risk for pregnant women aged older than 30 years old [9]



$p \leq 0.05$

Fig 2. Correlation between ages of pregnant women to thyroid status

Besides age factor, high-risk pregnant mothers are reportedly have higher prevalence of unplanned medical intervention [31]. There is a significant correlation ( $p < 0.05$ ) among pregnant women and gestation period, number of live birth/birth rate, and antenatal training. Increasing birth rate is accompanied by childbirth fear, which can be associated to previous childbirth experience [32]. Abortion risk factor is also significantly repeated among pregnant women [33].

Health promotion is really important for pre-pregnancy high-risk factor prevention [27], particularly to promote and develop strategy to control and evaluate policy implementation through enhancement of research in health [34]. Basic policy to support high-risk pregnant women needs to be designed in consideration of the policy benefit and feasibility [1], such as micronutrient and multivitamin consumption policy to reduce congenital abnormality rate from 4% to 2.1% [27].

Many pregnant women have inadequate knowledge on iodine deficiency disorders [29]. Thus, health education and support system for adolescent and young adults on the effect of iodine deficiency to pregnancy and childbirth need to be arranged [1]. Education on pregnancy and childbirth experience, antenatal care, and childbirth preparation is strongly suggested as it can help reduce pregnant women fear and anxiety [31]. Pre-pregnancy care is direct prevention to significantly reduce abnormal congenital birth, stillbirth, as well as prevent pregnancy complication and fetal defect [27].

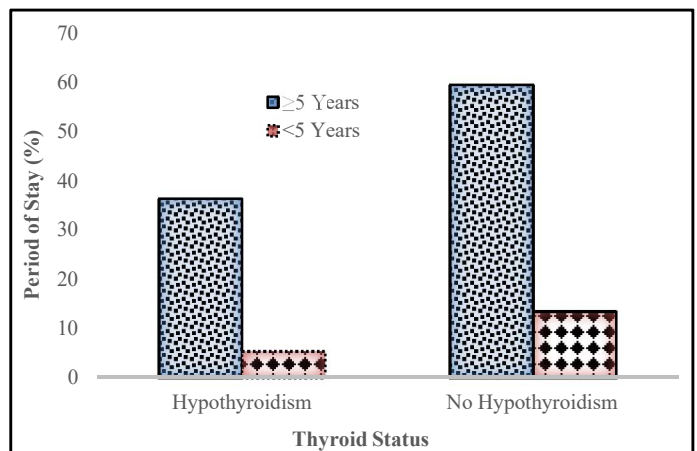
#### IV. DISCUSSION

Iodine deficiency is still a huge challenge throughout the world. High-risk areas usually apply policy programs to eliminate goiter prevalence [8]. Geographical and environmental landscape that predominantly consists of highlands might increase iodine deficiency incident [16]. Iodine deficiency in areas located in the highlands can be aggravated by erosion or flood which results in more severe soil iodine loss. Iodine cycle in nature is started when the

atmosphere absorbs iodine from sea which then recycles it back to soil through the rain and snow on mountains. River will bring it along to hills and lowlands, then back to sea. Such condition causes low iodine content in vegetation, animals, and organisms that live around highlands [35]. Iodine can be available from soil or crust, and then it is digested through food commodity planted on land. Various researches report that living in iodine deficiency area might as well cause iodine deficiency.

Pregnant women with inadequate iodine intake might have babies with delayed growth, and mothers with hypothyroidism might have fetal death in womb or in a week after delivery. Critical period of iodine deficiency effect is the middle of second trimester between 14-18 weeks [36].

American Thyroid Association (ATA) recommends adults, particularly women, to get thyroid dysfunction screening by TSH level serum measurement started at the age of 35 years old, with follow up every 5 years after. Individuals with clinical manifestation risk factor due to thyroid dysfunction need more frequent TSH check-up [37]. Thyroid dysfunction during pregnancy is prevalence clinical problems so that ATA establishes optimum care and guideline first released in 2011. From then on, various significant clinical and scientific progress have been obtained in thyroid diagnosis and handling, particularly for women during pregnancy, pre-conception, and postpartum [38].



$p \geq 0.05$

Fig 3. Correlation between Period Stay to Thyroid Status

Most of pregnant women have iodine level below WHO standard. Thus, they are prone to iodine deficiency disorder risk [28]. TSH serum examination during initial gestation is proven to be good predictor for thyroiditis postpartum, as well as to identify pregnant women with high-risk postpartum thyroid dysfunction. TSH and fT4 level need to be monitored every 4-6 weeks early in pregnancy and once during third trimester [39].

Pregnant women have abortus or low birth weight to increase nutrition pre-conception until gestational [40].

This research is conducted to prevent and even reduce high-risk complication among pregnant women living in iodine deficiency areas which are prone to iodine deficiency with adverse effects to both the women and their babies.

## V. RECOMMENDATION

It is recommended to prevent high-risk pregnancy in iodine deficiency area through education and information dissemination on health problems of high-risk pregnancy in such area, monitor on protection program from initial pregnancy stage through early deficiency and complication detection, screen of dysfunction thyroid symptoms, observation of pregnancy history and previous iodine deficiency, periodical examination of pregnant women iodine status in laboratory, and iodine intake monitoring during initial pregnancy stage through sufficiency of iodine availability from food, salt iodization, and iodine fortification.

## VI. CONCLUSION

Hypothyroidism is the most prevalent in high risk profile among pregnant women living in iodine deficiencies areas. This shows that such areas might affect the iodine availability for pregnant women living there. Other factors are the height of pregnant women, period of stay, birth distance and women age, respectively yet they are not statistically significant. Therefore, it is recommended to establish policy on continuous and sustainable program in coordination with related stakeholders and organizations in district level supported nationally by the government. The aim is to prevent severe effects due to high risk of pregnancy among women living in iodine deficiency area.

## RESEARCH LIMITATION

This research only covers 1 sub-district consisting of several villages. Each is composed by several hamlets or sub-villages. All pregnant women who meet the inclusion criteria or excluded living in the location are registered and as research subject. However, the number is considered as too few. Thus, further research needs to be conducted in expanded location to generalize research results.

## CONFLICT OF INTEREST

The researchers declare that there is no conflict of interest in this research.

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